REMARKS

In view of the above amendments and the following remarks, reconsideration and further examination are respectfully requested.

I.   Amendments to the Specification and Abstract

The specification and abstract have been reviewed and revised to improve their English grammar. The amendments to the specification and abstract have been incorporated into a substitute specification and abstract. Attached are two versions of the substitute specification and abstract, a marked-up version showing the revisions, as well as a clean version. No new matter has been added.

II.   Amendments to the Drawings

As mentioned above, a proposed drawing amendment is submitted herewith under a separate cover letter. Specifically, Figure 1 has been amended to be identified as prior art.

This drawing amendment is editorial in nature and does not add new matter to the application.

III.   Amendments to the Claims

Claims 2, 5, 6, 8, 10, 12, 14, 16, 17, 21, 23, 24, 26, 28 and 29 have been cancelled without prejudice or disclaimer of the subject matter contained therein

Further, independent claims 1, 13, 20 and 25 have been amended to clarify features of the invention recited therein and to further distinguish the present invention from the references

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relied upon in the rejections discussed below.

Moreover, dependent claims 3, 4, 7, 9, 11, 15, 18, 19, 22 and 27 have been amended to remain consistent with the above-mentioned claim amendments and cancellations.

It is also noted that claims 1, 3, 4, 7, 9, 11, 13, 15, 18-20, 22, 25 and 27 have been amended to make a number of editorial revisions thereto. These editorial revisions have been made to place the claims in better U.S. form. Further, these editorial revisions have not been made to narrow the scope of protection of the claims, or to address issues related to patentability, and therefore, these amendments should not be construed as limiting the scope of equivalents of the claimed features offered by the Doctrine of Equivalents.

IV.   35 U.S.C. §101 Rejection

Claims 20-24 were rejected under 35 U.S.C. § 101 for failure to recite statutory subject matter. This rejection is considered moot in regards to claims 21 and 24 based on their above-mentioned cancellation. Further, it is respectfully submitted that this rejection is inapplicable to amended independent claim 20, because claim 20 now recites a computer-readable recording medium having a computer program recorded thereon, such that the computer program causes a computer to execute a method. As a result, withdrawal of this rejection of independent claim 20 and claim 22 that depends therefrom is respectfully requested.

V.   35 U.S.C. §§ 102 and 103 Rejections

Claims 1-3, 7-9, 11, 13-15, 18-22 and 25-27 were rejected under 35 U.S.C. § 102(b) as being anticipated by Noda (U.S. 6,293,714). Further, dependent claims 4-6, 10, 12, 16, 17, 23, 24, 28 and 29 were rejected under 35 U.S.C. § 103(a) for being unpatentable over the combination of Noda and Hamilton (U.S. 5,715,381). These rejections are believed clearly inapplicable to amended independent claims 1, 13, 20 and 25 for the following reasons.

Amended independent claim 1 recites a print control apparatus including a division unit operable to divide print data obtained from outside the print control apparatus into files. Further, claim 1 recites a file management unit operable to manage the files using a hierarchy having at least three hierarchical layers, and operable to search the hierarchy for the files. In addition, claim 1 recites that the file management unit selectively uses, depending on the obtained print data, (i) a first management form for managing the files using hierarchical layers in the hierarchy, and (ii) a second management form for managing the files using hierarchical layers in the hierarchy, the hierarchical layers managed by the second management form being different from the hierarchical layers managed by the first management form. Claim 1 also recites that the first management form is for managing the files using two hierarchical layers by setting, for each print data, a storage area in a storage unit, and causing a writing unit to write the files generated from the print data into the storage area. Finally, claim 1 recites that the second management form is a management form for managing the files using three hierarchical layers, the management using the second management form being performed by setting (i) a storage area in the storage unit for

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each print data, and (ii) sub-storage areas in the storage area, and by causing the writing unit to write each of the files generated from the print data into a corresponding sub-storage area of the sub-storage areas in the storage area. Noda and Hamilton, or any combination thereof fails to disclose or suggest the above-mentioned distinguishing features.

Rather, Noda merely teaches dividing print data into plural jobs (see Figs. 1 and 12), but fails to disclose or suggest the print control apparatus (i) having a first and second management form, wherein the management forms utilize a different number of hierarchical layers (i.e., two and three layers) for managing the files divided from the print data, (ii) wherein the management forms (i.e., first or second) are selected depending on the print data, as required by claim 1.

Now turning to Hamilton, it is evident that Hamilton merely teaches managing files using only two hierarchical layers (see Figs. 23-25 and col. 13). Specifically, Hamilton teaches a first layer and various sub-layers stemming from the first layer (see col. 3).

Thus, in view of the above, it is clear that Hamilton only teaches managing files using two hierarchical layers, but fails to disclose or suggest that the second management form is a management form for managing the files using at least three hierarchical layers, the management using the second management form being performed by setting (i) a storage area in the storage unit for each print data, and (ii) sub-storage areas in the storage area, and by causing the writing unit to write each of the files generated from the print data into a corresponding sub-storage area of the sub-storage areas in the storage area, as required by claim 1.

For the reasons discussed above, it is also apparent that Hamilton also fails to disclose or suggest the print control apparatus (i) having a first and second management form, wherein the

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management forms <u>utilize a different number of hierarchical layers</u> for managing the files divided

from the print data, (ii) wherein the management forms (i.e., first or second) are <u>selected</u>

<u>depending on the print data</u>, as required by claim 1.

Therefore, because of the above-mentioned distinctions it is believed clear that claim 1

and claims 3, 4, 7, 9 and 11 that depend therefrom would not have been obvious or result from

any combination of Noda and Hamilton.

Furthermore, there is no disclosure or suggestion in Noda and/or Hamilton or elsewhere

in the prior art of record which would have caused a person of ordinary skill in the art to modify

Noda and/or Hamilton to obtain the invention of independent claim 1. Accordingly, it is

respectfully submitted that independent claim 1 and claims 3, 4, 7, 9 and 11 that depend

therefrom are clearly allowable over the prior art of record.

Please note that one of the benefits of the structure required by claim 1 is that the number

of search times to search for desired files is reduced by managing the files using three

hierarchical layers in a hierarchy assuming that plural file sets each include a predetermined

number of files stored together in a storage unit. More specifically, to properly reduce the

number of search times for each print data, the present invention selectively uses the first and

second management forms, each having a different number of hierarchical layers depending on

the print data. In light of the discussion above, the combination of Noda and Hamilton <u>does not</u>

provide the above-mentioned benefits of the features recited by claim 1, because the combination

of Noda and Hamilton merely teaches dividing print data into multiple jobs, wherein <u>only</u> a two

layer structure is utilized for organizing print jobs and wherein various management forms are

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<u>not</u> selected according to the print data.

Amended independent claims 13, 20 and 25 are directed to a method, a program, and a printer, respectively and each recite features that correspond to the above-mentioned distinguishing features of independent claim 1. Thus, for the same reasons discussed above, it is respectfully submitted that independent claims 13, 20 and 25 and claims 15, 18, 19, 22 and 27 that depend therefrom are allowable over Noda and Hamilton.

VI.   Conclusion

In view of the above amendments and remarks, it is submitted that the present application is now in condition for allowance and an early notification thereof is earnestly requested. The Examiner is invited to contact the undersigned by telephone to resolve any remaining issues.

Respectfully submitted,

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DESCRIPTION
PRINT CONTROL APPARATUS AND PRINT CONTROL METHOD

BACKGROUND OF THE INVENTION

5   ~~Technical Field~~

1. Field of the Invention

The present invention relates to a print control apparatus included in, for example, a printer, ~~especially~~ and more specifically relates to a print control apparatus that stores print data obtained

10   from a host computer and performs printing using the stored print data with no need to reobtain the print data.

~~Background Art~~

2. ~~Background~~Description of the Related Art

15   In general, a printer has a printer engine that performs printing based on the print data and a print control apparatus that controls the printer engine.

The print control apparatus like this obtains the print data ~~whose~~ having contents that show a text, a figure and the like to be

20   printed from an external host computer and temporally stores the print data.   After that, the print control apparatus reads the print data stored in a memory, causes its printer engine to print the contents shown by the print data and executes print processing such as erasing the print data used in the printing after completing

25   the printing.

Also, in the print control apparatus, a file management method that is compatible with Windows (a trademark of the Microsoft Corporation) of Microsoft Corporation is used in storing the above-mentioned print data with a view of universal use and

30   maintainability.   A   management   table   called   FAT (FileAllocationTable) is used as a file management method like this.

In other words, on obtaining a large number of print data

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from a host computer at one time, the print control apparatus temporally stores these print data using the above-mentioned FAT. After that, the print control apparatus searches the stored print data in an obtainment order using the FAT and execute printing processing based on the searched print data.

However, the above-mentioned print control apparatus has a problem:— such that in the a case where the number of print data to be stored (the number of files) increases, the FAT size becomes larger. This lengthen lengthens the time needed for searching and reading the file, resulting in affecting its userfriendliness.

Also, this problem is remarkable in a print control apparatus that has a memory print function.

The print control apparatus with a memory print function has a memory of large capacity. Several print data that are to be used in printing are written in the memory of large capacity (for example, refer to Japanese Laid-Open Patent No. 5-27929 publication, Japanese Laid-Open Patent No. 9-240070 publication and Japanese Laid-Open Patent No. 11-191041 publication). As a result, the print control apparatus like this can execute printing processing in a short time omitting the time needed for transmitting or expanding data from a host computer, but it requires more time for searching the print data or its file as the number of print data stored in a memory of large capacity increases.

FIG. 1 is an illustration for explaining a problem in the above-mentioned conventional print control apparatus.

For example, as shown in FIG. 1, the print control apparatus sets the file names of the respective print data and their addresses in the FAT when storing 5000 pieces of print data in a memory of large capacity. For example, here, in the case where the print control apparatus searches one print data from the stored 5000 pieces of print data and executes printing based on the print data, the average search times amounts to 2500.5 in the above search.

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The average search time is obtained from [average search times] = (the number of data+1)/2, in the case where the predetermined print data is obtained from plural print data in a linear search (the search performed starting from the head).

5   Further, in the case where the print control apparatus searches 100 pieces of print data and executes printing based on the print data, the average search times amounts to 2500.5× 100=250050 in the above search.

          In other words, in the above conventional print control
10 apparatus, it takes time for searching a file in this way.

          Therefore, the present invention is considered in order to solve the above problem, and an object of the present invention is to provide a print control apparatus and a print control method with an improved userfriendliness reducing the time needed for
15 searching a file to be printed.

~~Disclosure~~ Brief Summary of Invention

          In order to achieve t he above object, the print control apparatus, c oncerning the present invention, for controlling a
20 printer engine prints a content based on a file indicating the content to be printed, includes: a storage unit that has an area for storing the file; a writing unit that writes the file in the storage unit; and a file management unit that hierarchizes files to be written by the writing unit in the storage unit, that manages files in
25 a hierarchical form, and that searches the file based on a resulting hierarchy.

          In this way, plural files written in a storage unit are managed in a hierarchical structure. In searching a file, the search is performed based on the hierarchy, which enables further reducing
30 the average search times than in the case of not based on a hierarchy, in other words, enables reducing the time needed for

searching a file.   As the result, it becomes possible to improve its userfriendliness.

Also, in a first aspect of the present invention, the print control apparatus may further include: an obtainment unit that obtains print data indicating the content to be printed from outside the print control apparatus; and a division unit that divides the print data obtained by the obtainment unit into the files, in the apparatus, the writing unit writes the files divided by the division unit in the storage unit.

For example, the division unit divides the print data page by page and generates a file including information equivalent to each page.

In this way, the print data is written in a storage unit in a way that it is divided into plural files.   Therefore, in the case where a problem is generated on a part of the print data, only the file that corresponds to the part is affected by the problem and no other files are affected, which enables causing a printer engine to print the contents included in other files, and thus it becomes possible to avoid restricting the print range of the contents included in the print data.   For example, it is possible to print pages except the page including a part where a problem is generated, and it is possible to eliminate the possibility of printing pages after the page that corresponds to the part.

Also, in a second aspect of the present invention, in the print control apparatus, the file management unit may divide the files to be written in the storage unit into two layers in a hierarchy and may manage the files in a hierarchical form by setting one storage area for one print data in the storage unit and by causing said writing unit to write, in the storage area, the files generated from the print data.

In this way, as plural files divided from each print data are written in the storage area corresponding to each of the print data

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when plural print data are obtained, it is possible to reduce the number of files to be searched by finding the storage area corresponding to the print data first when searching all the plural files composing of a predetermined one print data, and thus it is possible to reduce the average search times for searching all target files.

Here, in a second aspect of the present invention, in the print control apparatus, the file management unit may selectively use, depending on print data obtained by the obtainment unit, a first management form for hierarchizing and managing the files, and a second management form for hierarchizing and managing the files in a way different from the first management form.

For example, the file management unit selectively uses a management form that , which divides the plural files into two layers in a hierarchy, as the first management form and a management form that divides the plural files into three layers in a hierarchy as the second management form.

In this way, the first management form and the second management form are selectively used depending on the print data to be obtained, which enables appropriately reducing the average search times for each print data.

Also, the file management unit may manage the plural files to be written in the storage unit by dividing the files into two layers in a hierarchy, by setting a storage area in the storage unit user by user and causing the writing unit to write the file obtained by the obtainment unit in the storage area of a user who generated the file.

In this way, a storage area is set user by user, which enables further improving the userfriendliness.

Note that the present invention can be realized as a print control method executed by the above-mentioned print control apparatus, a program for causing a computer to execute the

program, a storage medium for storing the program and a printer with the print control apparatus.

Brief Description of Drawings

5   FIG. 1 is an illustration for explaining a problem in a conventional print control apparatus.

FIG. 2 is a structural diagram showing the structure of the printing system in an embodiment of the present invention.

FIG. 3 is a block diagram showing the inner structure of the
10   printer.

FIG. 4 is an illustration for explaining the management method of the division file.

FIG. 5 is a flow cart showing how the above control unit performs the operation of writing the print data into the storage
15   unit.

FIG. 6 is an illustration for explaining the management method of the division file of the file management unit concerning the above variation 1.

FIG. 7 is a flow chart showing how the control unit
20   concerning the above variation 1 performs the operation of writing the print data into a storage unit.

FIG. 8 is a flow chart showing how the file management unit concerning the above variation 3 performs the operation of restricting the total number of the print data.

25   FIG. 9 is a flow chart showing how the file management unit concerning the above variation 4 performs the operation of restricting the total number of storage areas.

~~Best Mode for Carrying Out~~**Detailed Description of** the
30   **Invention**

The print control apparatus in the embodiment of the present invention will be explained below with reference to figures.

FIG. 2 is a structural diagram showing the structure of the printing system in the embodiment of the present invention.

The printing system includes a host computer 400 that generates and outputs the print data 401 showing the print contents such as a text and a figure and a printer 300 that obtains the print data 401 from the host computer 400 and prints the print contents shown in the print data 401.

The host computer 400 displays the memory inquiry display screen for inquiring a user of whether the print data 401 should be stored in the printer 300 or not before outputting the print data 401 to the printer 300. After that, the host computer 400 outputs a m emory execution signal showing the indication description along with the print data 401 to the printer 300 in response to a user operation at the time when it receives an instruction of causing the printer 300 to store the print data 401.

The printer 300 includes a printer engine 200 that performs printing based on the print data 401 and a print control apparatus 100 that controls the printer engine 200.

The printer 300 in the embodiment like this has a so-called memory print function and stores several print data 401 to be used in printing. With the memory print function like this, the printer 300 omits the time needed for transmitting and expanding data from the host computer 400 and executes the printing processing in a short time.

The print control apparatus 100 in the embodiment, in the case where it obtains the print data 401 and the memory execution signal from the host computer 400, it does not handle the print data 401 as one file but stores it by dividing it into plural division files 104a. Also, the print control apparatus 100 manages the division files 104a stored in this way using a FAT 104b. After that, the print control apparatus 100 outputs these division files 104a to the printer engine 200, causes it to not only print the print contents

included in the print data 401, but also store these division files 104a without erasing them so as to enable printing based on the print data 401 immediately and again.

Also, the print control apparatus 100, in the case where it
5   ~~obtains~~ does not obtain the memory execution signal but obtains the print data 401 from the host computer 400, temporally stores the files by dividing the print data 401 into plural division files 104a like the case mentioned above. After that, the print control apparatus 100 outputs these division files 104a to the printer
10 engine 200, and erases these division files 104a after causing it to print the print contents included in these print data 401.

FIG. 3 is a block diagram showing the inner structure of the printer 300.

The print control apparatus 100 of the printer 300 includes a
15 control unit 101 composed of a Central Processing Unit (CPU) and the like, a Read Only Memory (ROM) 102 that previously stores a program for print control executed by the control unit 101, a Random Access Memory (RAM) for enabling the control unit 101 to temporally store the data and read the data, a storage unit 104
20 that has an area for storing the division files 104a and the FAT 104b mentioned above, a user I/F unit 105 that interfaces between the user and the control unit 101, and an I/F unit 106 that interfaces between an external apparatus of the print control apparatus 100 and the control unit 101.

25 The user I/F unit 105 includes a display unit 105a that has, for example, a liquid display screen for displaying operational descriptions of the printer 300 or its setting descriptions and an operation unit 105b that has operation buttons used by the user.

The storage unit 104 is a memory of large capacity that
30 enables storing information of comparatively large capacity, and composed of a hard disc drive or a non-volatile semiconductor memory. Note that it may structure a storage unit 104 in a drive

that has a DVD, a CD, an MO and the like.

The control unit 101 in the embodiment includes a division unit 101a that divides the print data 401 into plural division files 104a, an R/W unit 101b that is a read/write unit for writing or reading the division files 104a in or from the storage unit 104, a file management unit 101c that manages the division file 104a to be written in the storage unit 104 using the FAT 104b and searches these division files 104a, and a file processing unit 101d that causes the R/W unit 101b to read the division files 104a searched by the file management unit 101c from the storage unit 104 and output these division files 104a to the printer engine 200.

The division unit 101a, on obtaining the print data 401 from the host computer 400 via the I/F unit 106, divides the print data 401, for example, page by page and generates data included in each of the pages as one division file 104a. In other words, the division unit 101a in the embodiment functions as an obtainment unit and a division unit. For example, the division unit 101a makes data included in the first page of the print data 401 into one division file 104a and makes the data included in the second page into another division file 104a.

The file management unit 101c in the embodiment sets the storage area corresponding to the print data 401 obtained by the division unit 101a by using the FAT 104b and causes the R/W unit 101b to write all the division files 104a divided from the print data 401 in the storage area. In this way, the file management unit 101c divides these plural division files 104a into two layers in a hierarchy and manages them.

To be more specific, the file management unit 101c stores the file name of the print data 401 and its address in the first column of the FAT 104b. Next, the file management unit 101c stores respective file names of the respective division files 104a that correspond to the print data 401 and their addresses in the

position of second column of the FAT 104b shown by the address in the first column of the earlier-mentioned FAT 104b.

FIG. 4 is an illustration for explaining the management method of the division file 104a.

For example, in the case where each of the 50 print data 401 including data equivalent to 100 pages is sent from the host computer 400, the division unit 101a divides these print data 401 into 100 division files 104a. As the result, 50×100 division files 104a are stored in the storage unit 104.

In this case, the file management unit 101c stores, in the first column of the FAT 104b, the file names of the respective print data 401 and their addresses showing the storage destination of the second column of the FAT 104b, the storage destination storing the information related to these print data 401. For example, in the first column of the FAT 104b, the file name "D0000001" and its address "ADDR1" are stored and likewise, the file name "D0000002" and its address "ADDR2" are stored.

Further, the file management unit 101c stores the file name and the address of the data unit in the second column of the FAT 104b as to respective division files 104a. For example, in the second column of the FAT 104b, the file name "D0000001.001" and its address "ADDR1_1" are stored as to the division file 104a corresponding to the first page of the print data 401 of the file name "D0000001", and the file name "D0000001. 002" and its address "ADDR1_2" are stored as to the division file 104a corresponding to the second page.

With the hierarchical structure like this, all the division files 104 corresponding to one print data 401 are stored in one storage area. For example, all the division files 104a corresponding to the print data 401 of the file name "D0000001" are stored in the storage area "D0000001".

Also, with a look of the first column of the FAT 104b, it is possible to know the file name of the print data 401 stored in the storage unit 104 and the address in the second column of the FAT 104b, the second column storing the information concerning the print data 401.   After that, with a look of the second column of the FAT 104b based on the address, the file name of the division file 104a corresponding to the print data 401 and its address of the data unit where the division file 104a is stored can be known.   In other words, this hierarchical structure is composed of a so-called link style.

FIG. 5 is a flow chart showing how the control unit 101 performs the operation of writing the print data 401 in the storage unit 104.

First, when the division unit 101a of the control unit 101 obtains the print data 401 via the I/F unit 106 (step S100), the file management unit 101c of the control unit 101 sets the storage area for storing the print data 401 in the storage unit 104 (step S102).   In other words, the file management unit 101c stores the file name of the print data 401 and its address in the first column of the FAT 104b.

Next, the division unit 101a initializes the count number Np of the installed counter to 1 (step S104), and extracts the data in the Np^{th} page from the print data 401 (step S106).

Further, the division unit 101a generates one division file 104a from the extracted Np^{th} page (step S108).

After that, the file management unit 101a causes the R/W unit 101b to write the generated division file 104a in the storage unit 104 (step S110).   Here, the file management unit 101a stores the file name of the division file 104a and its address in the second column of the FAT 104b.

After that, the division unit 101a judges whether the page next to the Np page exists in the print data 401 or not (step S112).

Here, in the case where it is judged that the next page exists (Y in step S112), the division unit 101a adds 1 to the count number Np so as to update this (step S114), and repeatedly executes the operation starting from step S106 again. Also, in the case where it is judged that the next page does not exist (N in step S112), the division unit 101a and the file management unit 101c finish the processing operation like mentioned above.

The print data 401 obtained from the host computer 400 are made into a form of plural hierarchized division files 104a so as to be stored in the storage unit 104 through the operation of the control unit 101 like this.

Next, the average search times at the time when the file management unit 101c searches one division file 104a from the plural division files 104a hierarchized in this way will be explained.

In a conventional example, an average search times of 2500.5 is required to search one file from 5000 files, but in this embodiment, it can be reduced to 76 times.

To be more specific, as shown in FIG. 4, the case of searching one division file 104a corresponding to the print data 401 of, for example, the file name "D0000002" in 5000 division files 104a stored in the storage unit 104 will be explained.

First, as the number of the file names of the print data 401 is 50, an average search times of $(50+1)/2=25.5$ times is required so that the file management unit 101c can search the file name "D0000002" of the print data 401 from the first column of the FAT 104b. Also, at the time of searching a file name from the FAT 104b in this way, the file management unit 101c compares the file names to be searched with the file names stored in the FAT 104b in an arrangement order of the files stored in the FAT 104b. Next, as there are 100 file names of the division file 104a, an average search times of $(100+1)/2=50.5$ are required so that the file management unit 101c can search the file name "D0000002.001"

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of the division file 104a corresponding to the print data 401 of the file name "D0000002" from the second column of the FAT 104b. Therefore, one division file 104a can be searched in an average search times of 25.5+50.5=76₂ as a whole.

5   Further, an average search times of 250050 is required for searching 100 files from 5000 files in a conventional example, but it can be reduced to 5075.5 times in the embodiment.

To be more specific, as shown in FIG. 4, the case of searching 100 division files 104a corresponding to the print data 401 of, for example, the file name "D0000002" in the 5000 division

10   files 104a stored in the storage unit 104 will be explained.

First, an average search times of 25.5 is required so that the file management unit 101c can search the file name "D0000002" from the first column of the FAT 104b.   Next, as the average

15   search times at the time of searching the file name of one division file 104a corresponding to the print data 401 of the file name "D0000002" is 50.5 as mentioned above, an average search times

of $50.5\times100=5050$ is required so that the file management unit

101c can search 100 division files 104a corresponding to the print

20   data 401.   Therefore, 100 division files 104a can be searched in an average search times of 25.5+50.5=76₂ as a whole.

In this way, in the embodiment, it is possible to reduce the average search times more greatly than in the conventional case even in both cases of searching one division file 104a and

25   searching all the division files 104a corresponding to one print data 401, and thus it is possible to reduce the time needed for searching the division file 104a.   As the result, it becomes possible to improve its userfriendliness.

The file processing unit 101d of the control unit 101 causes

30   the R/W unit 101b to read the division file 104a searched by the file management unit 101c from the storage unit 104.   In other words,

in the case where only the print data 401 is sent, but no memory execution signal is sent, from the host computer 400, and the print data 401 is made into a plural division files 104a and temporally stored in the storage unit 101, the file processing unit 101d causes the R/W unit 101b to read all the division files 104a corresponding to the print data 401 from the storage unit 104. Also, in the case where a user operates the operation unit 105b in a way that printing is performed based on the printing data 401 previously stored in the storage unit 104 and a signal corresponding to the operation is outputted from the operation unit 105b, the file processing unit 101d causes the R/W unit 101b to read all the division files 104a corresponding to the print data 401 desired by the user from the storage unit 104.

After that, the file processing unit 101d causes the printer engine 200 to output the division file 104a read right and print the contents of the division file 104a read right among the print contents included in the print data 401.

In other words, even in the case where there emerges a problem in reading one division file 104a from plural division files 104a corresponding to the print data 401, all the print contents included in the rest of the division files 104a are printed. In other words, all the pages except the page corresponding to the division file 104a where a problem emerged are printed.

In this way, in the embodiment, there is no possibility that a problem in reading a part of the print data 401 restricts the print range greatly, and it is possible to sufficiently limit the restriction of print range by the problem.

(Variation 1)

Here, the first variation concerning the file management method will be explained.

The file management unit 101c concerning this variation

divides plural division files 104a into three layers in a hierarchy so as to manage them.

In other words, when the division unit 101a obtains the print data 401, the file management unit 101c sets the storage area corresponding to the print data 101a in the storage unit 104 and sets plural sub-storage areas in the storage area. In other words, the file management unit 101c stores the file name of the print data 401 and its address in the first column of the FAT. Next, the file management unit 101c stores the file name and its address of a set file that integrates a certain number of division files or less which is corresponding to the print data 401 in the position in the second column of the FAT shown by the address of the first column of the FAT mentioned above. Further, the file management unit 101c stores respective file names and addresses of the respective division files 104a corresponding to the set file in the third column of the FAT shown by the address in the second column of the FAT mentioned above.

FIG. 6 is an illustration for explaining the management method of the division file 104a of the file management unit 101c concerning the variation.

For example, in the case where each of the 50 print data 401 that includes 100 page data is sent from the host computer 400, the division unit 101a divides the print data 401 into 100 division files 104a. As the result, 50×100 division files 104a are stored in the storage unit 104.

In this case, the file management unit 101c stores a file name of each print data 401 and an address showing the storage destination of the second column of the FAT 104c concerning the information related to these print data 401 in the first column of the FAT 104c. For example, in the first column of the FAT 104c, the file name "D0000001" and an address "ADDR1" are stored and

likewise, the file name "D0000002" and an address "ADDR2" are stored.

Further, the file management unit 101c stores, in the second column of the FAT 104c, each of the names of set files that integrate 10 or less division files 104a and the address showing the storage destination of the third column of the FAT 104c concerning the information related to the set file. For example, in the second column of the FAT 104c, the file name "D0000001_1" and its address "ADDR1_1" of the set file that integrates 10 division files 104a corresponding to 1st to 10th page of the print data 401 whose file name "D0000001" are stored. Also, likewise, the file name "D0000001_2" and its address "ADDR1_2" of the set file that integrates 10 division files 104a corresponding to 11th to 20th page are stored in the second column of the FAT 104c.

Also, further, the file management unit 101c stores a file name and the data part address of each division file 104a composing a set file will be stored in the third column of the FAT 104c. For example, the file name "D0000001.001" and its address "ADDR1_1_1" of the division file 104a corresponding to the first set file whose file name is "D0000001_1" are stored in the third column of the FAT 104c, and likewise, the file name "D0000001.002" and its address "ADDR1_1_2" of the division file 104a corresponding to the second division file 104a are stored.

In the hierarchical structure like this, all the division files 104 corresponding to one print data 401 are stored in one storage area. Further, a storage area includes plural sub-storage areas, and all the above division files 104 are divided and stored in the respective sub-storage areas. For example, all the division files 104a corresponding to the print data 401 whose file name is "D0000001" is stored in the storage area "D0000001", but these division files 104a are further divided for every 10 files and then each of the divided 10 files is stored in the sub-storage area of

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"D0000001_1", the sub-storage area of "D0000001_2" and the like.

Also, with a look of the first column of the FAT 104c, it is possible to know the file name of the print data 401 stored in the storage unit 104 and the address in the second column of the FAT 104c, the second column storing the information concerning the print data 401. After that, with a look of the second column of the FAT 104c based on the address, the file name of the set file corresponding to the print data 401 and its address of third column of the FAT 104c where the information related to the set file is stored can be known, and further, with a look of the third column of the FAT 104c based on the address, the data part address where the division file 104a corresponding to the set file is stored can be known.

FIG. 7 is a flow chart showing how the control unit 101 performs the operation of writing the print data 401 in the storage unit 104.

First, when the division unit 101a of the control unit 101 obtains the print data 401 via the I/F unit 106 (step S200), the file management unit 101c of the control unit 101 sets the storage area for storing the print data 401 in the storage unit 104 (step S202). In other words, the file management unit 101c stores the file name of the print data 401 and its address in the first column of the FAT 104c. Further, the file management unit 101c sets the sub-storage area for storing the set file in the storage unit 104 (step S204). In other words, the file management unit 101c stores the file name of the set file and its address in the second column of the FAT 104c.

Next, the division unit 101a initializes the count number Np of the counter to be installed to 1 (step S206) and extracts Np^{th} page data from the print data 401 (step S208).

Further, the division unit 101a generates one division file

104a from the extracted Npth page data (step S210).

After that, the file management unit 101a causes the R/W unit 101b to write the generated division file 104a in the sub-storage area of the storage part 104 (step S212). Here, the file management unit 101a stores the file name and address of the division file 104a in the third column of the FAT 104c.

After that, the division unit 101a judges whether the page next to the Npth page exists in the print data 401 or not (step S214). Here, in the case where it is judged that the next page exists (Y in step S214), the division unit 101a adds 1 to the count number Np so as to update this (step S216). On the other hand, in the case where the division unit 101a judges that the next page does not exist (N in step S214), the control unit 101 finishes the processing like mentioned above.

When the count number Np is updated in the step S216, the file management unit 101c judges whether the number of files of the division files 104a written in the sub-storage area is equal to or exceeds its upper limit or not (step S218). For example, the upper limit of files in the sub-storage area is 10. Here, in the case where the file management unit 101c judges that the number of files is under the upper limit (N in step S218), the control unit 101 repeatedly executes the operation starting from the step S208. Also, in the case where the file management unit 101c judges that the number of files is equal to or exceeds the upper limit (Y in step S218), the file management unit 101c sets a new sub-storage area (step S220). In other words, the file management unit 101a stores the file name and the address of a new set file in the second column of the FAT 104c.

After that, when a new sub-storage area is set in step S220, the control unit 101 repeatedly executes the operation starting from the step S208 again.

Next, the average search times at the time when the file

management unit 101c searches one division file 104a from plural division files 104a that are hierarchized in this way will be explained.

In the conventional example, an average search times of 2500. 5 is required to search one file from 5000 files, but in this embodiment, it can be reduced to 36.5 times.

To be more specific, as shown in FIG. 6, the case of searching one division file 104a corresponding to the print data 401 of, for example, the file name "D0000001" in 5000 division files 104a stored in the storage unit 104.

First, as the number of the file names of the print data 401 is 50, $(50+1)/2=25.5$ times is required as an average search times so that the file management unit 101c can search the file name "D0000001" of the print data 401 from the first column of the FAT 104c. Next, in order to search the file name "D0000001" of a set file corresponding to the print data 401 whose file name is "D0000001" from the second column of the FAT 104c, $(10+1)/2=5.5$ times is required as an average search times because the number of set file names is 10. Further, in order to search a file name "D0000001.001" of the division file 104a corresponding to the set file whose file name is "D0000001_1" from the third column of the FAT 104c, $(10+1)/2=5.5$ times is required as an average search times because the number of the file names of the division files 104a is 10. Therefore, one division file 104a can be searched in an average search times of $25.5+5.5+5.5=36.5$, as a whole.

Further, an average search times of 250050 is required for searching 100 files from 5000 files in a conventional example, but it can be reduced to 630.5 times in the embodiment.

To be more specific, as shown in FIG. 6, the case of searching 100 division files 104a corresponding to the print data 401 of, for example, file name "D0000001" in the 5000 division

files 104a stored in the storage unit 104 will be explained.

First, as mentioned above, 25.5 times is required as an average search times so that the file management unit 101c can search the file name "D0000001" from the first column of the FAT 104c.

Next, as the average search times at the time of searching the file name of one set file corresponding to the print data 401 of the file name "D0000001" from the second column of the FAT 104c is 5.5 times as mentioned above, 5.5×10=55 times is required as an average search times so that the file management unit 101c can search file names of 10 set files corresponding to the print data 401.

Further, an average search times at the time of searching a file name of one division file 104a corresponding to a set file whose file name is, for example, "D0000001_1" from the third column of the FAT 104c is 5.5 times like mentioned above. Therefore, in order to search the file names of the 10 division files 104a corresponding to the set file, 5.5×10=55 times is required as an average search times. The search like this needs to be respectively performed on the 10 set files corresponding to the print data 401, 55×10=550 times is required as an average search times.

Therefore, 100 division files 104a can be searched in an average search times of 25.5+55+550=630.5, as a whole.

In this way, in this variation, even in both cases of searching one division file 104a and searching all the division files 104a corresponding to one print data 401, and thus it is possible to reduce an average search times more greatly than in the conventional case and reduce the time needed for searching the

division file 104a. As the result, it becomes possible to improve its userfriendliness.

(Variation 2)

Here, the second variation concerning the file management method will be explained.

The file management unit 101c concerning the variation selectively uses different management forms depending on the number of pages or the number of divisions of the printed data 401.

For example, as mentioned above, the file management unit 101c selectively uses the first management form that manages the division file 104a by dividing it into two layers in a hierarchy, the second management form that manages the division file 104a by determining the upper limit of the sub-storage area as 5 and by dividing it into three layers in a hierarchy, and the third management form that manages the division file 104a by determining the upper limit of the sub-storage area as 10 and by dividing it into three layers in a hierarchy depending on the number of pages of the print data 401.

In other words, the file management unit 101c specifies the number of division files 104a that is divided and generated from one print data 401 by the division unit 101a and selects the management form with which an average search times becomes smallest among the first management form, the second management form and the third management form depending on the specified number. After that, the file management unit 101c manages the above-mentioned division file 104a using the selected management form.

For example, in the case where the print data 401 sent from the host computer 400 is made of 5 pages, the file management unit 101c manages five division files 104a of the print data 401

using the first management form with which the average search times becomes smallest. In other words, in the case where the five division files 104a like these are managed using the second management form and the third management form, the average search times needed for searching all the division files 104a from one print data 401 becomes greater.

Also, in the case where the print data 401 sent from the host computer 400 is made of 100 pages, the file management unit 101c manages 100 division files 104a of the print data 401 using the second management form with which the average search times becomes smallest.

Further, in the case where the print data 401 sent from the host computer 400 is made of 200 pages, the file management 101c manages the 200 division files 104a of the print data using the third management form with which the average search times becomes smallest.

In this way, the management forms are selectively used depending on the number of pages of the respective print data 401 sent from the host computer 400 in the embodiment, which enables reducing the number of average searching times for each print data 401.

(Variation 3)
Here, the third variation concerning the file management method will be explained.

The file management unit 101c concerning this embodiment prohibits a predetermined number of or more print data 401 from being written in the storage unit 104. In other words, the total number of print data 401 written in the storage unit 104 is restricted in this variation.

FIG. 8 is a flow chart showing how the file control management unit 101c performs the operation of restricting the

total number of print data 401.

The file management unit 101c, when the print data 401 is sent from the host computer 400, specifies the total number of the print data 401 stored in the storage unit 104 and judges whether 5 the total number of the print data 401 is under the predetermined upper limit or not (step S300).

Here, in the case where the file management unit 101c judges that it is under the upper limit (Y in step S300), it executes the operation of step S100 to step S114 shown in FIG. 5 together 10 with the division unit 101a and performs the processing of storing the sent print data 401 (step S302). Also, in the case where the file management unit 101c judges that it is not under the upper limit (N in step S300), the file management unit 101c performs error processing on the sent print data 401 (step S304). In other 15 words, the file management unit 101c does not execute the operation of step S100 to S114 shown in FIG. 5 together with the division unit 101a and disables writing in the storage unit 104. Further, the file management unit 101c causes the display unit 105a to display the message indicating that the sent print data 401 20 cannot be stored.

In this way, the total number of print data 401 stored in the storage unit 104 is restricted in this variation, which enables reducing the number of the average search times and reducing the time for searching.
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(Variation 4)

Here, the fourth variation concerning the file management method will be explained.

The file management unit 101c concerning this variation 30 disables the setting of a predetermined number of or more storage areas in the storage unit 104. In other words, in this variation, the total number of storage areas to be set in the storage unit 104

is restricted. Also, the number of print data 401 stored in the storage area in this variation is restricted to a predetermined number or less (such as 1).

FIG. 9 is a flow chart showing how the file management unit 101c performs the operation of restricting the total number of storage areas.

The file management unit 101c specifies the total number of storage areas that have already been set when trying to set the storage areas in step S102 in FIG. 5, and judges whether the total number of storage areas is under the predetermined upper limit or not (step S400).

Here, the file management unit 101c, in the case where it judges that it is under the upper limit (Y in step S400), performs the processing of storing the print data 401 sent from the host computer 400 by performing the operation of step S102 to S114 shown in FIG. 5 together with the division unit 101a (step S402). Also, in the case where it judges that it is under the upper limit (N in step S400), the file management unit 101c performs error processing on the sent print data 401 (step S404). In other words, the file management unit 101c disables the setting of the storage areas. Further, the file management unit 101c causes the display unit 105a to display the message indicating that the sent print data 401 cannot be stored.

In this way, the total number of the print data 401 to be stored in the storage unit 104 is restricted by imposing a restriction on the total number of the storage areas, which enables reducing the number of average search times in this variation like in the variation 3. As the result, it is possible to reduce the search time and improve its userfriendliness.

Up to this point, the print control apparatus concerning the present invention has already been explained with reference to an embodiment and variations 1 to 4, but the present invention is not

limited to them.

For example, in the embodiment and the variations 1 to 4, the division unit 101a generates the division file 104a by dividing the print data 401 on a page-by-page basis, but it is possible to

5   generate data included in the respective areas as respective one of division files 104a by dividing it on an area-by-area basis, the area being smaller than unit than a page.

Further, in the embodiment and the variations 1 to 4, the print control apparatus 100 has a memory print function, but the

10   present invention can be realized even in the case where it does not have any memory print function.   Also, as to the memory print function, it has already been explained that the print data 401 used in printing is stored in the storage unit 104 with a view of the use in later-printing in a form of a division file 104a without being

15   erased, but the print data 401 that has not been printed yet may be stored with a view of the use in later-printing.   In this case, the host computer 400, when sending the print data 401, outputs the above-mentioned memory execution signal and the print reserve signal disabling the prompt execution of the printing based on the

20   print data 401.

The control unit 101 of the print control apparatus 100 that obtained a print reserve signal like this generates division files 104a and writes them in the storage unit 104 without executing a prompt printing processing based on the print data 401 obtained

25   from the host computer 400.

Also, in the embodiment and the variations 1 to 4, the storage areas are set for each print data 401, but the storage areas may be set for each user.   In this case, the print data 400 sent from the host computer 400 is written in a storage area of a user

30   who generated the print data 400 as plural division files 104a.   In other words, the plural print data 400 generated by the same user is written in the same storage area.   In this way, it becomes

possible to improve its userfriendliness.

Further, the first management form, the second management form and the third management form that have been previously prepared are selectively used in the variation 2, but the

5   optimum management form may be selected depending on the obtained print data 401 and the print data 401 may be managed using the management form.   Also, management forms vary depending on the number of divisions of the print data 401 in the variation 2, but the management forms may vary depending on

10 user specifications.   In other words, the user inputs a desirable management form by operating the operation unit 105b.   In response to the input of the management form, the operation unit 105b outputs the signal notifying the management form to the file management unit 101c of the control unit 101.   The file

15 management unit 101c specifies the management form desired by the user by obtaining the signal and manages the print data 401 using the management form.   In this way, it becomes possible to improve the userfriendliness.

Also, in the embodiment and the variations 1 to 4, the print

20 data 401 is divided into plural division files 104a and these division files 104a are managed after being hierarchized, but plural print data 401 may be managed after being hierarchized on a print data 401 basis instead of being divided into division files 104a.

25 **Industrial Applicability**

The print control apparatus concerning the present invention provides an effect of making it possible to reduce the time needed for searching files and improve its userfriendliness and can be applied for printers and the like.

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ABSTRACT

The A print control apparatus 100 that reducesreducing the time needed for searching files includes and including a division unit 101a that obtainsobtaining the print data 401 from outside the print control apparatus 100 and divides itdividing the print data 401 into division files 104a, . The print control apparatus 100 also including a storage unit 104 that has an area for storing the division files 104a, an R/W unit 101b that writeswriting the division files 104a obtained by the division unit 101a in the storage unit 104 and a file management unit 101c that hierarchizes hierarchizing and manages managing the plural division files 104a to be written in the storage unit 104 by the R/W unit 101b, and searches searching division files 104a based on the layers in a hierarchy.